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EXPLORATION OF MOBILE EDUCATIONAL TECHNOLOGY

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Abstract: Recent advances in mobile and wireless technology could be utilised to enhance the delivery of educational programmes. The use of this technology is known as “Mobile Education”. Mobile education technology provides unique opportunities for educators to flexibly deliver their educational material to learners via mobile services anywhere at any time. Moreover, the material delivered could be adapted to the learners’ needs and preferences. Examples of mobile devices which could be used in mobile education are handheld mobile devices such as laptops, cellular phones, ipods, personal digital assistants (PDAs), wireless classroom instantaneous feedback response systems and many others. This paper surveys recent in-roads made in this field of educational technology and its envisaged impact on electrical engineering students learning experience.

1. Introduction:

Historically the use of computers and the internet enabled education providers of putting forward computer assisted courses and delivering their programmes online.

As a result of recent developments in mobile technology, educational facilities could be expanded to provide programmes and services anywhere and at any time. (Chen and Kinshuk, 2005) stated that education has become a life-long activity. People in current workforce, who wish to update their skills through off-campus programmes, can access educational material during breaks, evenings and on travel. They can also be informed of all necessary notices, assignment deadlines and supervisor advices during their busy schedule. It was also mentioned in the above reference that recent emergence of mobile technologies has made this task more feasible and convenient for those learners. Mobile education as defined by (Lehner and Nosekabel, 2002) as any service or facility that supplies a learner

with general electronic information and educational content that aids in acquisition of knowledge regardless of location and time. According to this definition, a mobile education system should be able of delivering educational programmes and services anywhere and anytime learners need it. The learners can either be students on university campus or students studying off university campus.

2. Types of mobile educational devices:

Mobile educational devices could be categorised into two groups, long-range devices and short-range devices

2.1. Long-range devices:

Examples of these devices are cellular phones, ipods, laptops and PDAs

2.2. Short-range devices:

An example of these devices are those which are equipped with the Bluetooth technology to establish a link between

electronic devices such as pcs, printers, mobile devices and PDAs to wireless data networks.

3. Mobile education technologies:

In this section a list of the state of the art technologies utilised in mobile education is provided. In addition, a brief technical description of each technology is given.

3.1. Global system for mobile communication (GSM):

The operating frequency for this system in Europe is 900 MHz and in the US is 1800 MHz. It is based on high speed circuit switched data (HSCSD) and general packet radio service (GPRS).

3.2. Short messages service (SMS):

This technology enables the sending and receiving of text messages to and from mobile phones.

3.3. Wireless application protocol (WAP):

It is an open and global standard designed for delivery of web function to mobile devices. Examples are connecting mobile devices to the internet and making mobile terminals capable of communication with other devices over a wireless network.

3.4. 3G technology:

The aim of this technology is to offer higher bandwidth and packet-based transmission of text, voice, video and multimedia. Using this technology computer and phone users can be connected to the internet and have access to set of devices worldwide. Integrating the

function of a whole range of different equipments, a 3G mobile phone can be used as a phone, a computer, a TV, a video- conference centre, a newspaper, an electronic diary and a credit card.

3.5. 4G technology:

This emerging technology enables wireless systems to outperform 3G wireless network in terms of higher bandwidth, better modulation techniques and smart antenna.

3.6. Bluetooth technology:

This is a low power, inexpensive, short-range, wireless standard supporting local area networks (LANs). It can replace cables and infrared links within a few meters range. Bluetooth can be used to link electronic devices such as pcs, printers and PDAs to short-range wireless data network

3.7. Extensible (far-reaching) mark up language (XML):

This is a meta language designed to communicate the meaning of data through a self-describing mechanism. It tags data and puts content into context, thereby encoding semantics into their documents. For XML compliant information systems data can be exchanged directly even between organisations with different operating systems as long as the organisations agree on the meaning of the data that is being exchanged. XML is extensively used in mobile applications development.

3.8. Wireless mark up language (WML):

This language is derived from XML and has been specifically developed for

wireless applications protocol (WAP). It allows information to be represented as cards suitable for display on mobile devices. WML is an analogue to HTML in terms of functioning to WAP as HTML to http.

4. Types of mobile educational services:

These could be classified into three types of services, educational organisation to business organisation (E2B) service, educational organisations to students (E2S), service and students to students service (S2S). Exploration of these services is covered in this section.

4.1. Educational organisations to business organisations (E2B):

E2B covers mobile education services within and between educational organisations and business organisations. Mobility integrated into these organisations has the potential to make information flows more efficient and thus improve the supply chain management of necessary educational material and equipment. For example, mobile email and internet enable instant data and information exchange between educational establishments and their supply business partners. With the aid of a laptop, GSM modem and a connected mobile phone, educational establishments purchasing managers can dial into the corporate network's email server and stay in touch with their own organisations and their supply chain managers while being away from the office. Mobile services can also be used to manage logistics and inventory control. For example, Bluetooth devices are ideal for inventory control of educational laboratory equipment and

other necessary material. Instead of users making manual connection, Bluetooth devices connect and communicate spontaneously. Thus, they provide fast data sharing and quick stock control. In addition, they enable the supply chain partners to share stock data.

4.2. Educational organisations to students (E2S):

Here are some examples of these services:

- Mobile phones that supply campus information such as a notice about a cancelled class or change of venue or an announcement posted on a virtual learning environment (WebCT for example)
- Ipods transformed into a text-based browser enabling students of reading their course notes whilst listening to their favourite music (Foster, 2005).
- Mobile phones with 3G technology enabling students to gain access to the internet even when there are no wireless hot spots near by. Thus, enabling them to check emails, class schedules and grades.
- Mobile phones with GPS technology enabling students to track the whereabouts of the campus bus service.
- Mobile phones with added information technology feature enabling the students to check the local weather forecast, university emergency phone numbers and entertainment channels such as one that has celebrity photographs.
- Mobile phones with educational oriented services for example enabling students to take academic quizzes so they find out if they are

grasping a concept or other service which could help students connect with their tutors.

- Mobile phones which could alert campus security guards if students are walking at night alone and are nervous about being attacked.
- Mobile financial services for students to enable students to settle their tuition and other fees via wireless internet websites. MasterCard has plans to invest heavily on Media laboratories to develop new ways for mobile devices customers to pay for their purchases whilst on the move. These financial services also include paying for mobile entertainment such as mobile gaming, mobile music and music gaming. Thus, these services offer mobile students new ways of entertainment while on the move.
- Mobile shopping of books and other stationary items enabling students to pay for these needed items anywhere and at any time. Thus, enabling the students to have access to personalised, immediate opportunity to purchase. This mobile shopping facility is open 24/7 and is now available in many wireless websites. For example, Amazon.com developed a URL that allows internet-ready wireless devices to access its shopping services (Hillebrand, 2000).

4.2. Students to Students Services:

In this service students communicate with other fellow students in order gain access to missed course notes or to demystify some unclear lectures or discussion group projects or group coursework. As an

example of these services, is gaining webCT internet access via discussion boards.

5. Limitations to mobile educational technology:

In this section, the limitations to mobile education will be discussed.

5.1. Mobile devices limitations:

Mobile terminals demonstrate a greater mobility and flexibility. However, they are inferior to personal computer and laptops. This is because they have a small screen and the display resolution is so low. Mobile handlers are also limited in computational power, disk capacity and battery life. These limitations impede the educational applications of mobile devices. However, mobile communication technology is advancing rapidly and it is expected that the limitations mentioned above will gradually disappear in future.

5.2. Incompatible network standards:

There are multiple, complex and competing protocols existing in present cellular network standards. GSM is a single standard used by network operation in Europe and Pacific Asia. In the USA TDMA (time-division multiple access) and CDMA (code-division multiple access) are used. These incompatibilities in networks impose serious patterns for companies in serving their customers.

5.3. Competing web languages:

Newer mobile phones will use WAP and its WML. But some companies are still using HTML. Standardisation of web languages is extremely important to sort

out the problem of interacting between mobile service organisations and their customers.

5.4. Security concerns/trust:

Wireless communications are vulnerable in comparison to wired applications. Wireless data networks provide acceptable levels of encryption and security. However, the technology does not ensure absolute transmission security. Serious efforts must be directed towards the issue of security in developing future mobile applications.

6. Examples on the applications of mobile education in engineering and computing:

(Mussay and Khatri, 2006) reported a project which is focused on the use of mobile learning devices such as pen-based writing tablet pcs and collaborative conference Xps in developing learning by doing or problem-based learning environment of mobile applications development for graduate students. The development of this mobile learning environment was realised as a collaborative effort involving industry, staff and students. In addition, it involved multi-disciplinary academic departments at the University of Indiana, Bloomington. The departments involved are information technology, computer science and the business school. The project was a success as reported by the students, industry and staff. This project demonstrated the impact of mobile learning devices on learning by doing or problem-based learning.

(Tan and Goh, 2006) reported a mobile proportional, integral and differential (PID) controller for a thermal chamber. The controller is implemented to control

the temperature inside the chamber via controlling the brightness of a lamp and the speed of a fan using pulse width modulation (PWM) techniques. The PID simulator can run on colour-display handheld mobile devices such as personal digital assistants (PDAs) and cellular phones which uses WAP technologies. This enables students of using wireless mobile learning technology in order to explore the effect of PID parameters on the behavioural temperature responses to a control input prior to conducting their laboratory sessions. Following to this the students can effectively use the limited laboratory time in order to come to grips with the overall PID control system performance whilst conducting the experiment.

(Sakkapoulos, Lytras and Tsakalidis, 2006) reported on the development of a mobile learning environment using handheld devices for internet technologies. This includes mobile web-development programming and multimedia messages (MMS). The mobile environment is also used as a communication tool between academics, administrators and students. For example, students can check their financial details, course announcements, class and laboratories schedules, their grades...etc

This reference concludes that students without a computer infrastructure and part-time students have an alternative opportunity to receive educational material on internet technologies and to engage on the development process of these technologies using their mobile devices.

7. Conclusions:

In this paper mobile education devices, techniques and services are explored. The devices fall into two categories, long and

short range types. Current mobile education enabling technologies are listed and discussed. These are global systems for mobile communication (GSM), short messages services (SMS), wireless applications protocol (WAP), 3G and 4G technologies, Bluetooth technology, extensible mark up language (XML) and wireless mark up languages (WAP). The features and applications of each of these technologies are highlighted. The types of mobile education services are described as E2B (Educational organisation to Business organisations), E2S (Educational organisations to students) and S2S (Students to Students). The uses and properties of these types are investigated. Limitations to mobile education technologies are summarised as mobile devices limitations, incompatible networks, competing web languages and security concerns or trust. Finally, some examples of applications for mobile education in engineering are given. The areas covered by these examples are design, development and assessment of mobile applications, development of a mobile spreadsheet-based PID control simulation systems and adaptive mobile web services that facilitate communications and learning of the internet technologies.

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